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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
AHMED, SAMIR ANWAR	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/735,097	Applicant(s) WEISGERBER ET AL.	
	Examiner Samir A. Ahmed	Art Unit 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 17 January 2006.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 29-50 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 29-551 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 1/17/06 has been entered.

2. The amendment filed 1/17/06 have been entered and made of record.

3. Applicant's arguments filed 1/17/06 have been fully considered but they are not persuasive with regard each independent claim for the following reasons:

Applicant alleges, "processing 2-D and 3-D data in combination to form or identify [,]" (page 6, last eight lines-page 7, line 2). The Examiner disagrees. Firstly, Mengel clearly states "with advanced 3D laser-scan techniques and combined evaluation of gray-level (2D image) and height images (3D images), very extensive and reliable quality inspections can be performed (page 788, RC, lines 20-22), i.e., Mengel recognizes the use of both 2-D and 3-D data in evaluation and provided why he is using the combination. Secondly, in Mengel, the two-dimensional gray-level and three dimensional height images of the PCB surface are acquired simultaneously (page 787, RC, lines 7-8). The evaluation is based on multitude of geometric shape features (3 D data) surface properties (2 D data) and their mutual relationships (page 787, RC, lines 25-27). The reliability of classification produced by 3D data can be enhanced by adding gray scale features (2D data) (page 788, LC, lines 1-5), i.e. processing as a function of the 3 D and 2 D data.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 29-30, 3436, 38, 41-44, 48, 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of P. Mengel "Automated Inspection of Solder Joints on PC Boards by Supplementary Processing of 3D and Gray-level Images", IEEE Industrial Electronics Society, vol. I, pp. 786-791, November 27, 1990 and Donald J. Svetkoff et al. "Automated Inspection of Component Boards using 3D and Greyscale Vision", Proceedings of ISHM, pp. 58-64, Nov. 1986.

As to claim 1, Mengel discloses a method for inspecting electronic components mounted on a printed circuit board with a mounting substance, each of the components including electrical interconnects to the circuit board as typified by leads or endcaps (Fig. 3, shows an inserted component on a PCB using solder (mounting substance) and the component having leads), the method comprising:

imaging the components and the mounting substance on the printed circuit board to obtain 3D and 2 D data associated with the components and material surrounding the component (Page 787, RC, lines 1-13, Fig.1)), and

processing the 3 D and 2D data in combination to form blob and edge images to find the location of the component as a function of 3D and 2D data and based on identified leads, endcaps or other component features as differentiated from the

mounting substance and circuit board on which the component is placed [the 3D data and 2D data are processed in combination (page 788, RC. lines 20-22), a 3D plot of the shape, position, orientation and height of the inserted component is formed (blob image) (Fig.3, and Fig. 7, top images) and Sobel filtered gray level image showing the distribution of brightness (edge image) is formed (see Fig 7, top images are blob and bottom images are edge images, page 789, LC, the bottom 7 lines). The correspondence between the 3 D (blob image) and the grayscale edge image (2D data) locates the component based on identified leads (see Fig. 7, page 789, RC, lines 1-13)]. Mengel does not explicitly disclose wherein the step of processing includes evaluating the blob and edge images.

Svetkoff discloses an automatic quality assurance inspection system for surface mounted components by using 3D imaging combined with grayscale (2D data) for the most robust solution to discriminate components, solder paste, and backgrounds, for precisely locating components, detecting deviations from coplanarity, tombstoning and other defects (page 61, paragraph. VI.). Edge information (edge image) is used to determine the component position (evaluating edge image). However, ambiguities can arise if edge information alone is used alone. For example, if a component is missing, edges from a printed pattern on the PCB below the missing component could appear in the window used for edge detection. Without further information these edges in the edge image could be confused as the edges of the component on the PCB. The presence or absence of a component in a detection window can be determined by a matching algorithm having programmable tolerances (thresholds). A compact

representation of each component (blob image) is stored in the database along with inspection tolerances. During inspection shape matching is performed using the stored blob image to determine the presence of the component within the tolerance band (threshold range), its approximate height and orientation in 3D space (page 61, LC, lines 15-500, i.e., the blob image is analyzed and the combined evaluation of the blob image and the edge image is used to find the locations of the components as a function of the 3D (shape, height) and the 2D (grayscale) data. Mengel and Svetkoff are combinable because they are from the same field of endeavor of circuit inspection using combined 3D and 2D data. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Svetkoff's teachings to modify Mengel's method by evaluating the blob and edge images to find the locations of the components as a function of the 3D (shape, height) and the 2D (grayscale) data in order to provide a robust inspection system which can accurately determine solder paste and component placement for both process verification and quality control inspection.

As to claim 30 both Mengel (Abstract, lines 6-9) and Svetkoff (Abstract, lines, lines 1-6) further discloses, wherein the mounting substance is solder paste.

As to claim 34, Svetkoff further discloses, wherein the leads have feet and wherein the step of processing includes the step of calculating the average height of the feet (Abstract, lines 20-24, page 58, RC, lines 33-34, page 62, LC, first two lines).

As claim 36, Svetkoff further disclose, wherein the step of processing includes the step of processing the 3-D data together with upper and lower threshold values to find the location of the leads and the mounting substance [3D shape matching is

performed to determine the existence of component in tolerance band (threshold range, which by definition has upper and lower values) to find the components and mounting substance (page 61, LC, lines 26-50)].

As to claim 38, Svetkoff further discloses, wherein the step of processing includes the step of applying at least one threshold to the at least one of the 2-D and 3-D data threshold range, which by definition has upper and lower values) to find the components and mounting substance (page 61, LC, lines 26-50)].

As to claim 41, both Mengel (page 788, LC, line 22- page 789, LC, line 5) and Svetkoff (page 61, lines 15-50) further discloses, wherein the step of processing comprises comparing at least one of a predetermined three-dimensional size and shape of a component with 3-D data representative of the component so as to verify component presence.

As to claim 42, refer to claim 41. Size and shape are attributes of a component.

Claim 43, is a system analogous to the method of claim 29, arguments analogous to applied to claim 29 are applicable to claim 43. Svetkoff further discloses a high speed image processor (Abstract, lines 1-6; page 62, LC, lines 8-20).

Claim 44, is a system analogous to the method of claim 30, arguments analogous to applied to claim 30 are applicable to claim 44.

Claim 48, is a system analogous to the method of claim 34, arguments analogous to applied to claim 34 are applicable to claim 48.

Claim 51, is a system analogous to the method of claim 36, arguments analogous to applied to claim 36 are applicable to claim 51.

6. Claims 33, 47, 37, 39-40, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of P. Mengel "Automated Inspection of Solder Joints on PC Boards by Supplementary Processing of 3D and Gray-level Images", IEEE Industrial Electronics Society, vol. I, pp. 786-791, November 27, 1990 and Donald J. Svetkoff et al. "Automated Inspection of Component Boards using 3D and Greyscale Vision", Proceedings of ISHM, pp. 58-64, Nov. 1986 as applied to claims 29 and 43 above and further in view of Montillo et al. (US 6,526,165).

As to claims 33, and 47, neither Mengel nor Svetkoff discloses, wherein the step of processing includes the step of calculating the centroids of the feet. Montillo discloses a geometric descriptions method that specifies the location of object features and dimensions of object features relative to each other, so that precise tolerance checking and defect detection can be performed and properly registers the object with the pads on a PCB, such that the centers of the feet of the object align with the centers of the pads on the PCB within the positional tolerances (col. 1, lines 25-37). The centroids of the object feet are calculated (col. 6, lines 3-31). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Montillo's teachings to modify the combined method of Mengel and Svetkoff by calculating the centroids of the feet in order to perform precise tolerance checking and defect detection and align the centers of the feet of the object with the centers of the pads on the PCB within the positional tolerances (col. 1, lines 25-37).

As to claims 37, 39-40 and 50, neither Mengel nor Svetkoff discloses, wherein the step of processing comprises masking at least one of the 2-D and 3-D data with the

blob image; detecting an edge of the blob image and applying a bounding rectangle to the edge; and wherein the bounding rectangle is a minimum area rectangle, and wherein the bounding rectangle is used to determine component position and orientation. Montillo discloses a geometric descriptions method that specifies the location of object features and dimensions of object features relative to each other, so that precise tolerance checking and defect detection can be performed and properly registers the object with the pads on a PCB, such that the centers of the feet of the object align with the centers of the pads on the PCB within the positional tolerances (col. 1, lines 25-37). A blob tool is used to perform masking the 2D data with the blob image in order to create an image that contains only the object of interest (the foot) (col. 13, line62-col. 14, line 15). Detecting an edge of the blob image and applying a bounding rectangle to the edge wherein the bounding rectangle is a minimum area rectangle, and wherein the bounding rectangle is used to determine component position and orientation (col. 13, line 62-col. 14, line 15; Fig. 12b, element 1210).). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Montillo's teachings to modify the combined method of Mengel and Svetkoff by masking at least one of the 2-D and 3-D data with the blob image; detecting an edge of the blob image and applying a bounding rectangle to the edge; and wherein the bounding rectangle is a minimum area rectangle, and wherein the bounding rectangle is used to determine component position and orientation in order to perform precise tolerance checking and defect detection and align the centers of the feet of the object

with the centers of the pads on the PCB within the positional tolerances (col. 1, lines 25-37).

7. Claims 31-32, 45-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of P. Mengel "Automated Inspection of Solder Joints on PC Boards by Supplementary Processing of 3D and Gray-level Images", IEEE Industrial Electronics Society, vol. I, pp. 786-791, November 27, 1990 and Donald J. Svetkoff et al. "Automated Inspection of Component Boards using 3D and Greyscale Vision", Proceedings of ISHM, pp. 58-64, Nov. 1986 as applied to claims 29 and 43 above and further in view of Prosky (US 4,159,648).

As to claims 31-32, neither Mengel nor Svetkoff discloses, wherein the mounting substance is an adhesive and the adhesive is glue. Prosky discloses the use of conductive glue to mount and retain components on surfaces of circuit boards (col. 1, line 65- col.2, line 5, and col. 3, lines 44-50, col. 4, lines 46-49), in order to permanently attach the component to the mounting surface and reduce the cost of the time consuming soldering of the components (col. 1, lines 26-40). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Prosky's teachings to modify the combined method of Mengel and Svetkoff by using conductive glue to mount and retain components on surfaces of circuit boards in order to permanently attach the component to the mounting surface and reduce the cost of the time consuming soldering of the components (col. 1, lines 26-40).

8. Claims 35 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of P. Mengel "Automated Inspection of Solder Joints on PC

Boards by Supplementary Processing of 3D and Gray-level Images", IEEE Industrial Electronics Society, vol. I, pp. 786-791, November 27, 1990 and Donald J. Svetkoff et al. "Automated Inspection of Component Boards using 3D and Greyscale Vision", Proceedings of ISHM, pp. 58-64, Nov. 1986 as applied to claims 29 and 43 above and further in view of Kent et al. (US 6,047,084).

As to claims 35 and 49, Mengel discloses determining the quality of solder joints using test parameters and degree of inspection including solder bridges and excess solder (Page 790, RC, lines 5-11). Neither Mengel nor Svetkoff discloses, calculating a percentage of pixels classified as the mounting substrate that are at an area of interest border to determine a potential for bridging between adjacent solder deposits and the percentage of pixels comprises a border violation percentage. Kent discloses determining a coverage area of two polygons such as the solder paste 200 and a pad 202 of Fig. 2. Coverage area represents the percentage of one polygon such as solder paste 200, that overlies or intersects the other polygon such as pad 200 (border violation percentage). Coverage area is calculated (col. 11, line 60-col. 12, line 26). The polygons are areas in an image, which inherently includes pixels (picture elements). Thus the percentage is indeed a percentage of pixels within the polygon image. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Kent's teachings to modify the combined method of Mengel and Svetkoff by calculating a percentage of pixels classified as the mounting substrate that are at an area of interest border to determine a potential for bridging between adjacent solder deposits and the percentage of pixels comprises a border violation percentage in order

to provide an improved inspection method that bases part rejection on mechanical and electrical connectivity capability rather than on the relative location of the part, thereby minimizing excessive rejection rates that can seriously impact capacity and throughput for the automated circuit assembly process (col.1, lines 46-51).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Samir A. Ahmed whose telephone number is (571) 272-7413. The examiner can normally be reached on Mon-Fri 8:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Bella can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SA

SAMIR AHMED
PRIMARY EXAMINER